

MA 1118 - Multivariable Calculus
Exam III - Quarter IV - AY 99-00

Instructions: Work all problems. Read the problems carefully. Show appropriate work, as partial credit will be given. One page 8-1/2x11, one side notes.

1. (10 points) a. What is the domain of: $f(x, y) = \ln(x^2 + y^2 - 1)$
b. What, if any, possible points of discontinuity are in that domain?
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2. (20 points) Given

$$f(u, v) = uv^2 + \sin(uv) \quad , \quad \text{and} \quad u = x^2y \quad , \quad v = xe^{xy}$$

find $\frac{\partial f}{\partial x}$, $\frac{\partial^2 f}{\partial u^2}$ and $\frac{\partial^2 f}{\partial v \partial u}$

3. (25 points) a. Find the linearization of:

$$f(x, y) = 2x \cos(2y) + y$$

in the region: $R : |x - 1| \leq .3 \quad , \quad |y| \leq .2$

- b. Find a reasonable upper bound on the error in this linearization over R .
c. Use your answer from part a. to estimate the value of $f(1.05, .15)$.
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4. (20 points) Consider the function of two variables given by

$$f(x, y) = x^3y - 3xy^2 .$$

- a. Find an equation for the tangent line to the level curve of $f(x, y)$ at $P_0(1, 1)$.
b. Find the direction of steepest *descent* for this function at $P_0(1, 1)$.
c. Find the equation of the plane tangent to the surface

$$z = x^3y - 3xy^2$$

at the point on the surface corresponding to P_0 .

5. (25 points) Find and correctly identify all the local maxima, minima and saddle points of

$$f(x, y) = 6x^2 - 2x^3 + 3y^2 - 6xy$$
